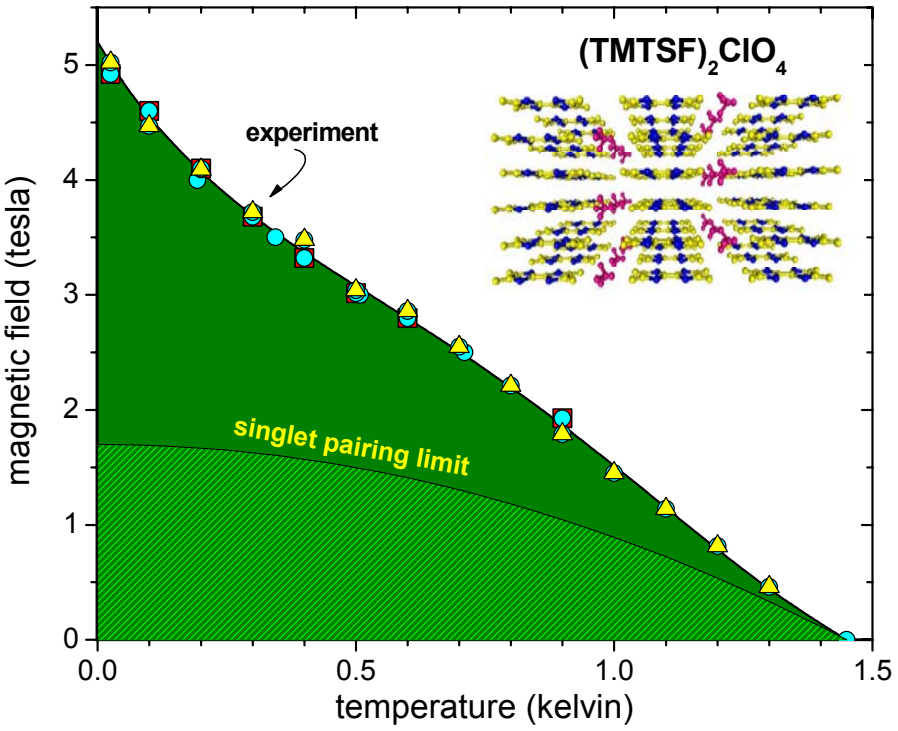
Molecular Organic Conductors: Triplet Superconductivity and Novel Angular Magnetoresistance Effects

M.J. Naughton, Boston College, DMR-0308973

Superconductivity is known to be suppressed by magnetism. This is achieved via interaction of a magnetic field with the orbital and spin angular momenta of superconducting electron pairs. One can avoid the latter "spin pair-breaking" by having pairs form in a "triplet" state, where the two spins are aligned in parallel. Such triplet pairing is extremely rare in nature, only fully established so far in superfluid ^{3}He.

In general, one can never avoid the "orbital pair-breaking" effect. However, the molecular organic superconductor $(TMTSF)_2ClO_4$ shows evidence of avoiding *both* effects. The figure shows that the critical magnetic field for this material far exceeds a theoretical estimate of the maximum field in which superconductivity should be able to survive -- suggesting a certain unique and potentially useful immunity to magnetism.



Adapted from J.I Oh and M.J. Naughton, Physical Review Letters 92, 067001 (2004).

Molecular Organic Conductors: Triplet Superconductivity and Novel Angular Magnetoresistance Effects

M.J. Naughton, Boston College, DMR-0308973

Education:

One undergraduate student (Rob Caldwell), two graduate students (Jeong-Il Oh and Heon-Ick Ha) and one post-doc (Joel Moser) contributed to this project. Rob has entered graduate school at Columbia University, Jeong received his Ph.D. in 2003 and is now a post-doc, and Heon-Ick will receive her Ph.D. in 2004.

Outreach:

In collaboration with Prof. M. Barnett of the Lynch School of Education at Boston College, a summer outreach program involving high school students from Boston area schools will be operated in the summers of 2004 and 2005. Six students and six teachers will come to BC for hands-on activities centered around molecular organic conductors and high magnetic field research.

.